The Characters of Planet X

not "bad guys" ; rather, ...

"misguided"

... fame & fortune awaits

The names are being withheld ...

to protect the guilty.

Mystery Guest # 1

Halley residuals: explained by secular term

$(\sim$ standard non-grav formulae)

Plot : signature back to 295 AD

"If Planet X were the cause instead, this
signature would reflect the effect of Planet X."

Labels the plot: "Effect of the

Hypothetical Planet [!] on Halley's Comet"

Table : post-fit residuals from secular term

back to 295 AD

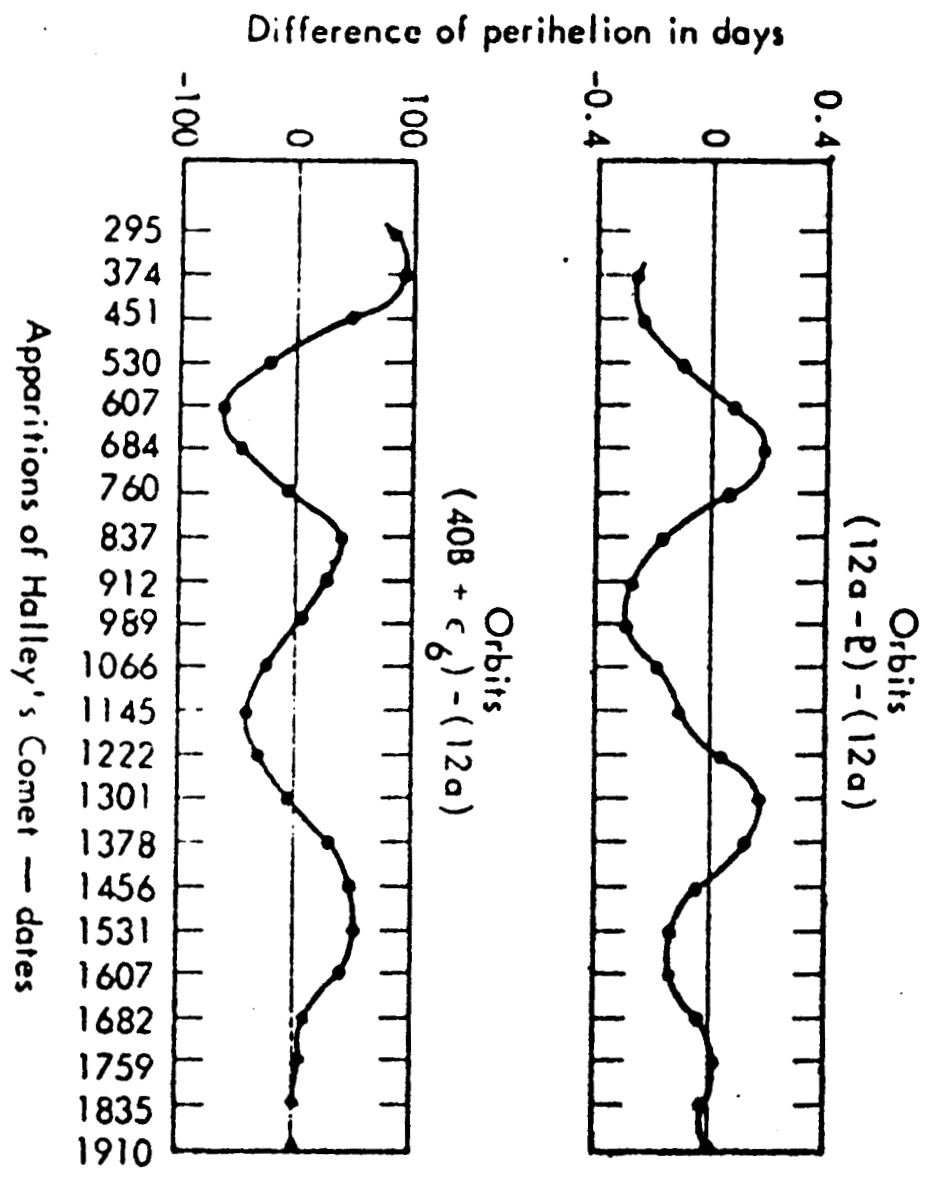Table : post-fit residuals from Planet X

back to 1456 AD

!!!

Difference of perihelion in days

Orbits
$(12a - \mathbb{P}) - (12a)$

Orbits
$(40B + c_6)^2 - (12a)$

Apparitions of Halley's Comet — dates

FIG. 1 — Effect of Pluto and the hypothetical planet on Halley's comet.

TABLE I
PERIHELION PASSAGES AND RESIDUALS OF HALLEY'S COMET

Year of apparition [1]	T Julian Date (adopted) [2]	ΔT Orbit 12a [3]	ΔT Orbit $40B + \epsilon_6$* [4]	ΔT Orbits $(12a - P) - (12a)$ [5]	ΔT Orbits $(40B + \epsilon_6) - (12a)$ [6]
1910	241 8781.67872	$0\overset{d}{.}0$	$0\overset{d}{.}0$	$0\overset{d}{.}0000$	$0\overset{d}{.}00$
1835	239 1598.93817	0.0	0.0	-0.0088	0.00
1759	236 3592.55178	+4.2	0.0	+0.0180	+4.17
1682	233 5655.79506	+8.2	0.0	-0.0358	+8.21
1607	230 8303.71595	+42.6	-0.1	-0.1312	+42.66
1531	228 0492.792	+53.5	+0.2	-0.1214	+53.34
1456	225 3021.202	+49.6	-0.8	-0.0482	+50.35
1378	222 4684.770	+29.4	-2.1	+0.1315	+31.55
1301	219 6543.700	-8.7	-3.7	+0.1869	-5.03
1222	216 7646.0	-51.6	-19.1	+0.0470	-32.48
1145	213 9378.	-40.5	+1.1	-0.0982	-41.65
1066	211 0500.	-12.8	+7.5	-0.1791	-20.29
989	208 2535.	+0.8	-0.5	-0.283	+1.27
912	205 4366.	+28.7	+2.4	-0.270	+26.33
837	202 6828.	+37.8	-2.9	-0.164	+40.67
760	199 8810.	+14.8	+20.2	+0.066	-5.38
684	197 1199.	-18.1	+30.3	+0.193	-48.34
607	194 2843.	-60.9	+1.8	+0.081	-62.68
530	191 4959.	+27.7	+49.1	-0.083	-21.44
451	188 5969.	+55.2	+7.7	-0.240	+47.54
374	185 7705.	+95.2	+0.4	-0.263	+94.73
295	182 8903.	+69.3	-15.5		+84.83

* $\epsilon_6 = 2.635 \times 10^{-9}$.

50.0

3   020
7   339
3   550
2   0573
    1805
    8700

$\omega = 181°$
$\Omega = 115°.75$
$i = 120°$

5
09
years

TABLE II

RESIDUALS OF HALLEY'S COMET WITH AND WITHOUT THE TRANS-PLUTONIAN PLANET

Year of apparition	ΔT Orbit 12a 9 planets	ΔT Orbit 52B 10 planets
1910	$0^d.0$	$0^d.0$
1835	0.0	−0.8
1759	+4.2	−0.8
1682	+8.2	−3.0
1607	+42.6	−2.7
1531	+53.5	+2.5
1456	+49.6	+3.9

like those of Figure 4, is being made for the 1986 apparition in order to find where the zero solu-
tions are...

Helpfully, he gives both the cartesian and the keplerian elements of his final Planet X orbit.
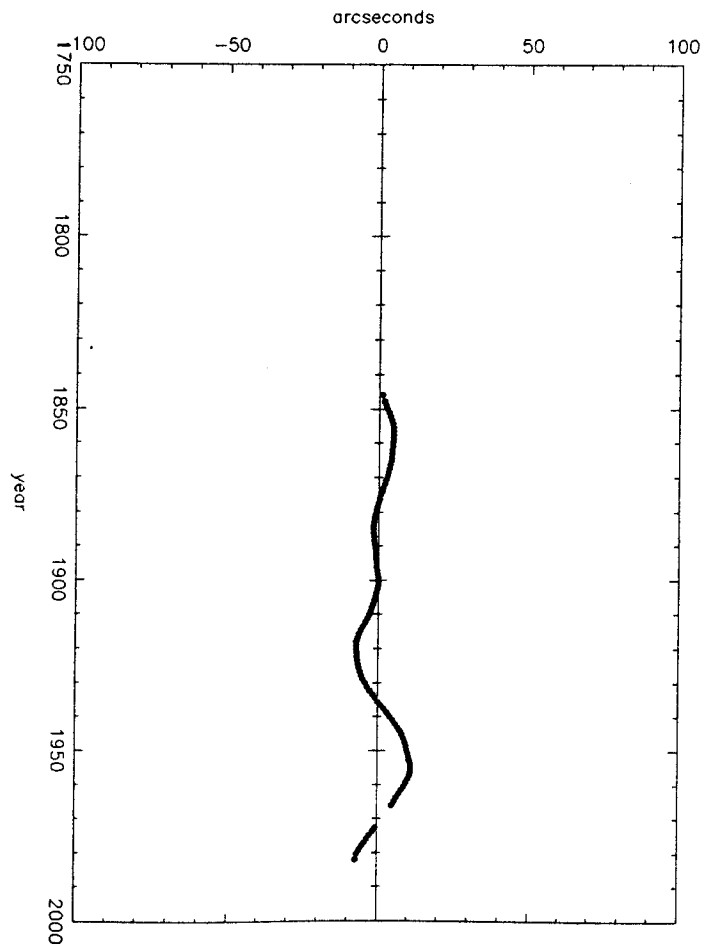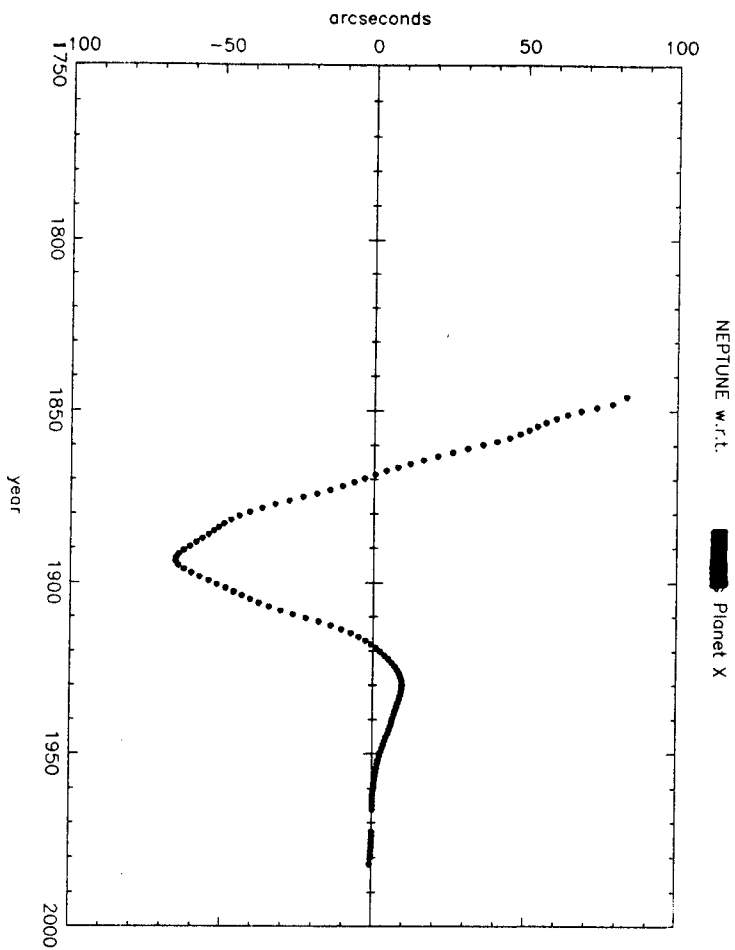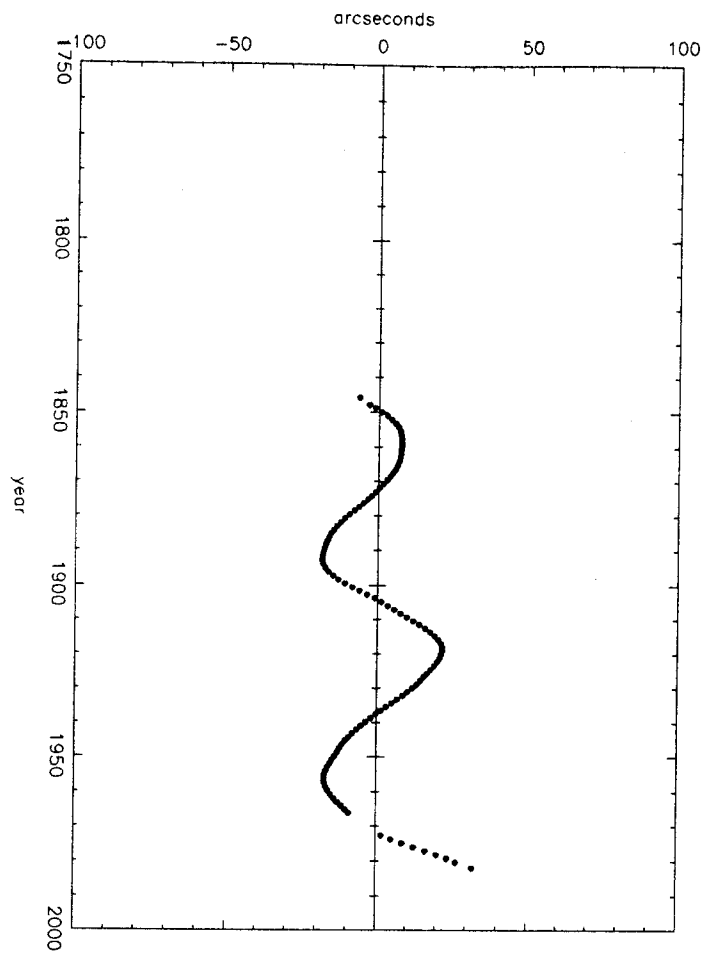
Only one problem : they are not the same orbit.

$$M_X = 300\ M_\oplus\ !!! \qquad = M_J\ !!!$$

"If a trans-Plutonian planet is to be plausible, its effect on the other planets must be small enough that ... "

"A program to demonstrate this by ... , a lengthy undertaking, is now in progress."

[silence]
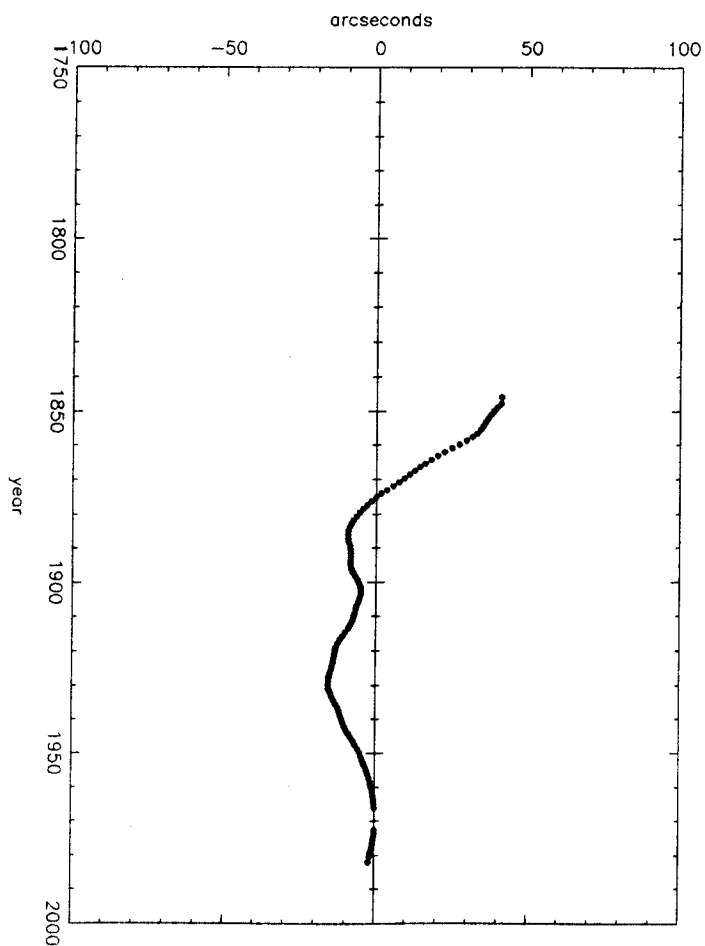
More Recent Pronouncements

"The motions of Uranus and Neptune cannot be adequately represented within the present gravitational model of the solar system."

"All of the Uranus observational data cannot be fit with a single ephemeris."

"...systematic differences between the observations and ephemerides of Uranus and Neptune..."

"Attempts to change the planetary masses within reasonable constraints did not reduce the residuals."

The race was on.

Mystery Guest # 2

"The data improvement about 1910... was due ..., he thought, to new techniques..., particularly advancements in photographic emulsions."

After a long derivation and mathematical exposé, he pointed to his result :

"You can all stop searching around,
because Planet X is right there."

$$[\ m_X = 12.2\ (!)\ ]$$

"It is hard to see how Tombaugh could have missed it. ...

"Either Tombaugh was mistaken in thinking that he could not have missed a planet brighter than 16th magnitude,

   or

my calculations are mistaken."

More likely, he feels, his gravitational model of the outer solar system is wrong, perhaps because there is an eleventh planet out there whose gravitational effects are confusing matters.

"... if the discrepancies have any cause other than a planet X, all the results here obtained would make little sense."

In response to a referee questioning the level of significance:

"...if the last ten years of observations were suppressed from the least squares analysis, a quite different set of corrections would be determined."

Mystery Guest # 4

Ref: "Your method doesn't work since ϵ isn't small."

[paper rejected]

Nevertheless, soon in another journal, we find

" ... with $\epsilon = a_N/a_X$, I find ..."

[$\epsilon \approx 0.7$]

****

"... errors in the masses of some of the known planets may be a possible source of the observed systematic residuals."

[He then chose a non-Voyager mass for Neptune]

" ... systematic behavior in the longitude residuals ... is much smaller than before. ... residual trends can be produced by uncertainties in the ... masses ..."

[but he didn't solve for the masses ...]

"Would a collision on Uranus explain its systematic residuals?"

"We demonstrate, however, that he under-estimated the energetics of such an encounter by twelve [!] orders of magnitude..."

"... a possible explanation of the systematic residuals shown in Fig. 1"

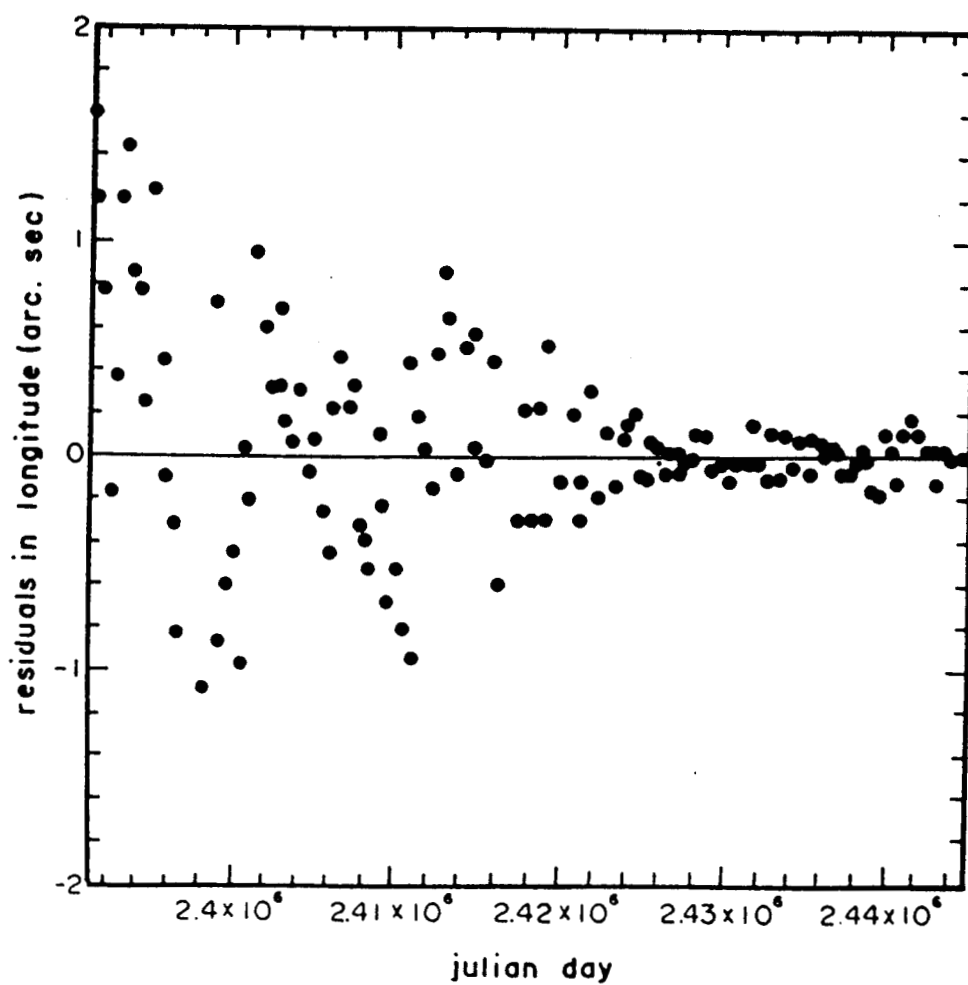"The residuals in longitude, after the inclusion of the impact, are shown in Fig.3. The fit is good, ..."
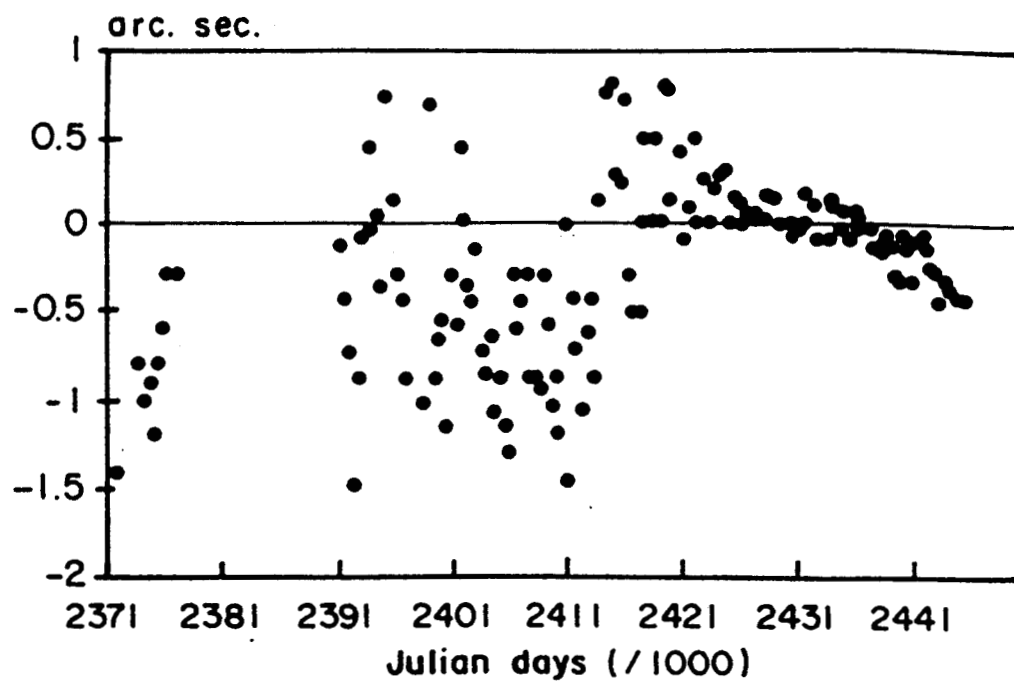
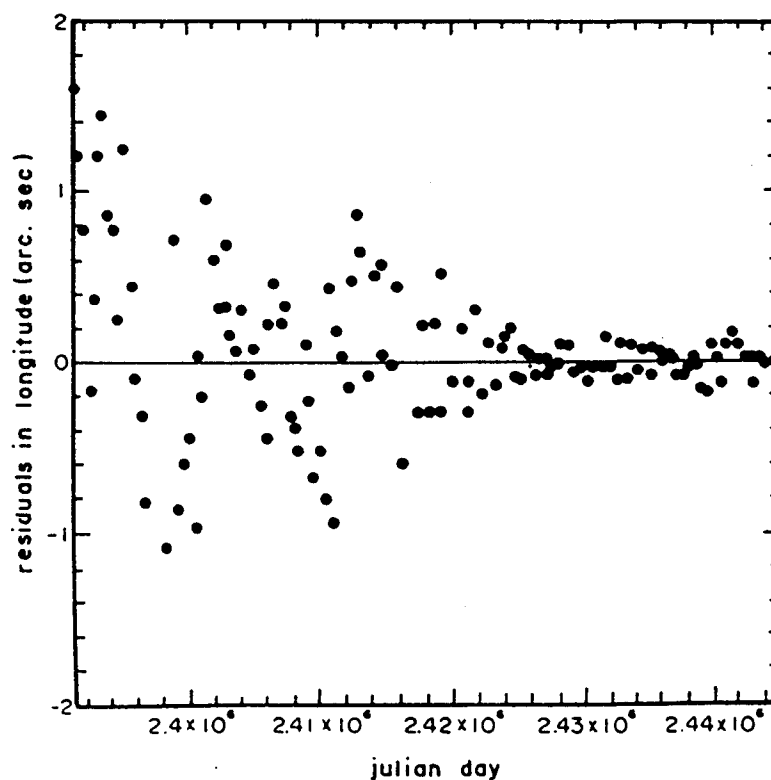Fig. 3. Residuals in longitude after the inclusion of the collision
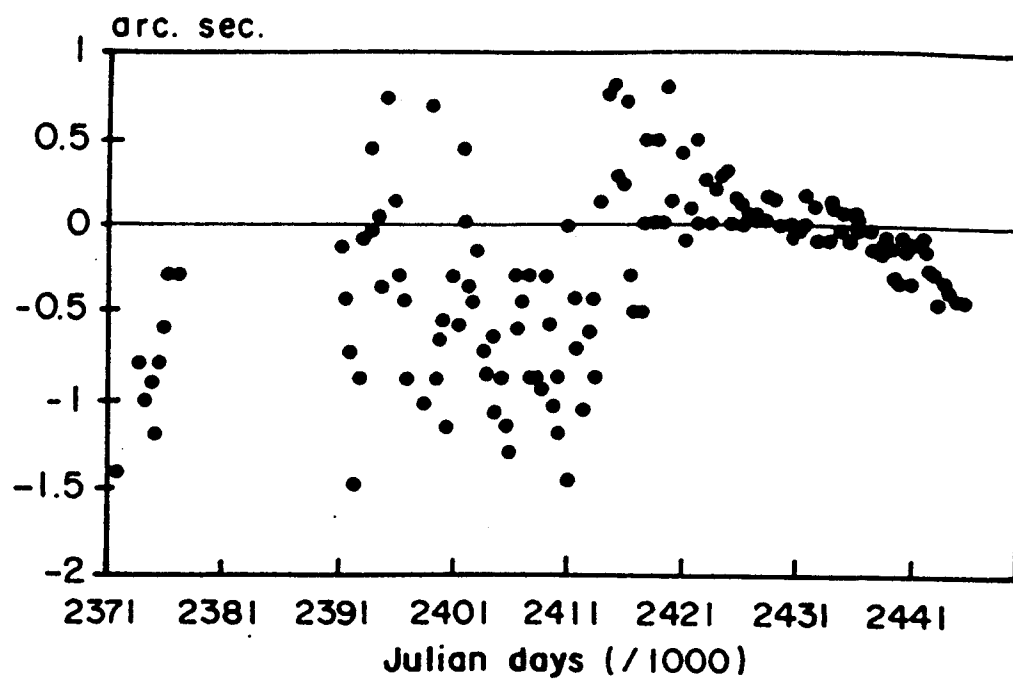
Fig. 3. Residuals in longitude after the inclusion of the collision

Mystery Guest # 5

" Xxxxx* is paid to be a skeptic... Just like Myles has an obligation to go to his boss and say, 'We've got the solar system under control. Here it is. Now you can fly your mission.' For me to come along and say, 'Aha, you've overlooked the 10th planet' – that makes them look bad."

"I sure don't feel this is worth putting a lot of time on, but NASA at least gave me $15K this year to look.

[coverage diagram]

"The Location of Planet X" (!)

GALACTIC PLANE
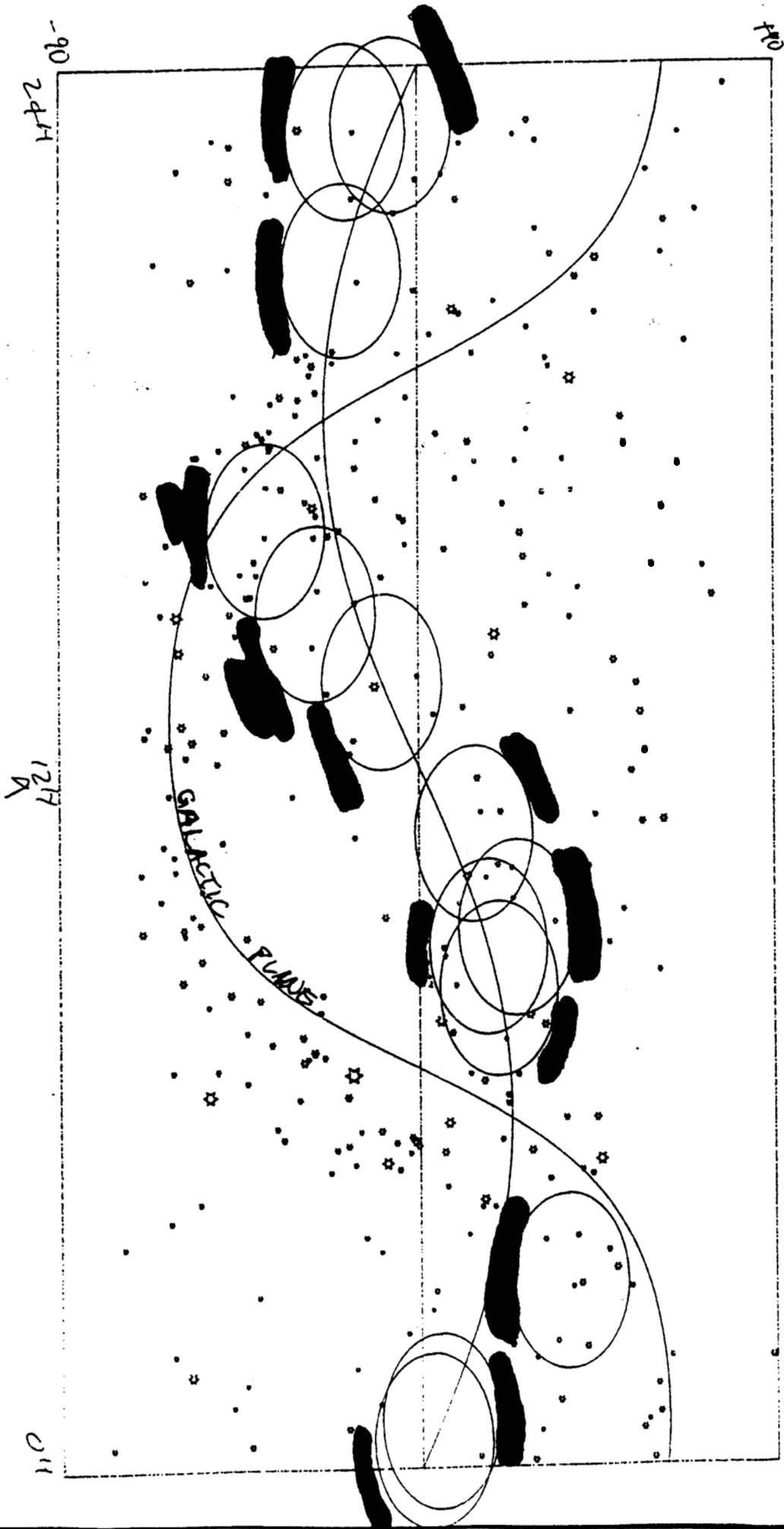
Mystery Guest # 6

Primary author in a paper describing
    the 1911 improvement from the
      impersonal traveling micrometer

"But about that time [ca. 1910] a strange thing happened:

  Neptune and Uranus started behaving themselves."

"He said that he has studied the older data extensively, ...".

  [he never had the data in his possession]

"Well, yeah; I'm trying to get more funding ..."

Sobering comments

"We are being less than honest when we pretend to be able to predict the location of any mass on the basis of this optical data.

Further, we are misleading competent observers and wasting valuable telescope time."

"If you must make a prediction, be smart; predict the planet to be where Tombaugh didn't search."

1991

Intention : Show that the optical data problems

are big enough to

account for the Uranus residuals

First   : Be certain that Uranus' orbit is

well-fit to the data

NO

First   : Adjust for the correct Neptune mass

I.e., Voyager!

Then   : Re-fit Uranus' orbit

Voila !

" Xxxxx* is paid to be a skeptic...

* Cosmic Cop

Brian Marsden: Cosmic Cop

By David H. Levy

For 25 years, Brian Marsden has chore-ographed the comings and goings of astro-nomical discovery from his vantage as director of the Central Bureau for Astronomical Tele-grams. Photograph by David Levy.

"MASTER of the Universe!" That was how a newspaper headline once described Brian Marsden, *the* man who decides who gets credit for discovering anything astronomical that moves or explodes in the sky. This month I salute Marsden as he celebrates 25 years as director of the International Astronomical Union's Central Bureau for Astronomical Telegrams.

Marsden polices the sky from his office at the Smithsonian Astrophysical Observatory in Cambridge, Massachu-

with a laugh. "That was a Saturday."

During his long career, Marsden has had his share of adventures. In 1957, while a summer student at the Royal Greenwich Observatory, then located at Herstmonceux Castle in southern England, some of his colleagues hatched a plan to handcuff and kidnap him. "I like to think they were concerned I was working too hard," Marsden recalls. Fortunately, two female colleagues warned him of the impending prank, and Marsden avoided his office on the